

Relationship between Motivation and Student's Activity on Educational Game

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Abstract

Many research results convinced that instructional games have positive effects on academic achievement. Game-based learning have aroused attention and interests of educators, parents and game company from all aspects, because of educational potentials which embedded in games; it opened and changed the views towards digital games. The purpose of this study was to identify the effect of the activity levels of educational game on the intrinsic motivation of the learners. The result of this research, there are meaningful difference in intrinsic motivation between learners who use games on the higher level of activity and learners on the lower level of activity in game-based learning. The intrinsic motivation of extrovert learners' improved more than that of introvert learners' in game-based learning.

Keywords: *Intrinsic Motivation, Activity Level, Educational game*

1. Introduction

Today's learners have grown up with digital games, and their constant exposure to the Internet and other digital media has shaped how they receive information and how they learn. An increasing number of faculties are using games as enhancements to the traditional learning environment with encouraging results [1]. Digital games have potential as a learning environment because they are a form of play that motivates learners through entertainment elements.

And also, it has various activity for learning by doing that include competitive, rules, challenge, goals, curiosity, feedback, interaction, interest, fantasy [2, 3, 4, 5], motivation [6, 7, 8], flow [9], control, and narrative [5, 10, 11, 12].

For this reason, digital games are user-centered; therefore, they can promote challenges, co-operation, engagement, and the development of problem solving strategies in learning [7]. There is an emphasis upon choices [3], games as choices foreground decision making skills facilitating a greater emphasis upon decision making as a learning component [13].

Many research results convinced that educational games have positive effects on academic achievement. Game-based learning have aroused attention and interests of educators, parents and game company from all aspects, because of educational potentials which embedded in games; it opened and changed the views towards digital games. In recent years there has been no shortage of efforts to design and develop educational games for learning [7, 14, 15].

Game-Based Learning is suitable for teaching complex subject matter. Main features of instructional games are establishing strategies, verifying hypothesis, and solving problems. Especially, adventure and strategy games include visible strategies which can promote

creative problem solving and decision making. Such games also can foster players' inquiry skill which requires higher order thinking.

The positive effects of game-based learning already discussed and explored by various researches, can be classify into two perspectives as we conclude, it is said that playing games can promote students' academic achievement, through special subject education which support by selected games. For instant, domains of language, literacy, science, math, arts, history, are the most list subjects which tend to take advantages of integrating with games. On the other side, students' general abilities such as self-efficacy, problem solving, decision making, logical thinking, creativity, communication and so on, can be developed by playing games. Previous theoretical and empirical researches provide sufficient both quantitative and qualitative statistics to confirm these positive effects.

However, as many educators already foresee, it is not an easy task to achieve the two objectives of education and fun at the same time. The more fun the game has, the weaker the learning becomes and vice versa. In fact, it is difficult to imagine and then devise a scenario where both learning contents and gaming situations occur simultaneously while balancing fun and learning. This balancing act between enjoyment and educational value continues to be a hot topic in discussions about developing educational games [12].

With the attention of the games deeply, educators begin to focus on the educational potentials of games. First game as a media, there are sound music, vivid animations, intricate plots the characters with distinct personality, so the involvement of game can be called a kind of enjoyment of art. Second, the player through various designed circumstances, and to complete the task, in the process of playing, their ability of resolving problems and corporation promote increasingly.

Specially, the online Role Playing Game(RPG) which can incorporate some education content, players can obtained in the course of the geography, history, culture, daily life, animals and plants, tourism, a few interesting physical and chemical knowledge, because such knowledge is relatively easy to express by the scenes, maps, tasks, skills and other elements of the game.

Regardless of how the game was demonized, if we can objectively understand the positive effects of games, and make the best use of it to promote learning, it should have great advantages and potential. Many educators and scholars at home and abroad have initiated research and development of the educational game based on the pros and cons, they try to explore application model, and already have achieved some positive results [5, 8, 16, 17, 18, 19].

Vansteenkiste et al. [20] said that students placed in an intrinsic motivation condition processed reading material more deeply, achieved higher grades, and showed more persistence than students placed in an extrinsic condition. In this study, they argue the benefits focused on academic achievements of an arena in which fantasy in educational game arouse interest, intrinsic motivation, and so on.

And also, Squire and Jenkins [8] assert that the game is more than an exercise for students; it allows them to share a common experience and use this as a basis for more detailed discussions. They address the game that are not simply problems or puzzles; they are micro-worlds, and in such environments students develop a much firmer sense of how specific social processes and practices are interwoven and how different bodies of knowledge relate to each other.

Like this, much effort to use educational games for students' learning is being made actively at educational filed focus on motivation. Roles of learners and instructors are undergoing considerable changes in current view of the constructivism, and the changes in the

teaching-learning method are dynamic, correlating with changes in the whole contemporary socialites. For this reason, this research was started.

In this study the activity levels of the educational game are main variables to be explored. It is expected that the results of this study would suggest how to utilize educational games in teaching and learning. The purpose of this study is to examine the relationship between intrinsic motivation and activity level on educational game.

2. Theoretical Background

2.1 Game Based Learning

Game-Based Learning (GBL) is used to describe the application of games to learning or educational purpose. While the games refer to different kinds of video and computer games [5, 21], such as simple question-and-answer games, off-the-shelf games, educational games or multiplayer online games no matter played on a game console or computer [16, 22, 23, 24].

However, using the characteristics of video and computer games to create engaging and immersive learning experiences for delivering specified learning goals, outcomes and experiences are also belonged to this field [13]. Examples can be found from using short periods of time but fun, and ubiquitously available simple Flash animation game to attract and motivate students to learning, in Second Life which with great 3D graphics construct immersive learning environment [25, 26].

Researches in GBL, in general, there are three approaches for educators integrating games into the learning process [21]: have students build games from scratch [27, 28, 29, 30]; develop a new educational games which incorporate in some specific educational goals [15] [31] and using carefully selected and instructed commercial off-the-shelf (COTS) games into the classroom to promote students' academic achievements and abilities [19, 24, 32, 33, 34].

In conclude from these aspects, GBL can promote academic achievement, high order thinking high self-esteem co-ordination education rehabilitation improved [7, 34, 35, 36]. Moreover with the proverbially diffuse of online games, especially, they allow for spontaneous formation of social networks which can be a new collaborative learning in GBL [37, 38].

As studies have shown the benefits of effective use of GBL are considerable, and the essential of effectiveness is that games create intrinsic motivation through fantasy, control, challenge, curiosity, and competition. But motivation needs to be sustained through feedback responses, reflection and active involvement in order for designed learning to take place [11].

Therefore the key challenge for effective learning with games is for the learner to be engaged [3, 13] games provide an engaging and immersive learning environment, these environments are psychologically immersive in ways that the world-to-the-desktop interface is not [39], and leverage players' natural desires to develop new skills, participate in new roles, or better understand the world from a new or "professional" perspective [40]. This is a way to earn personal experience because game-based learning is often experience-based or exploratory, and therefore relies upon experiential, problem-based or exploratory learning approaches [13, 18].

Wider use of games for supporting formal educational and training objectives and outcomes is one of trends of game based learning. While a key challenge for designers then is to get the correct balance between delightful play and fulfilling specified learning outcomes [13, 38, 41].

Prensky [5] argued that GBL works primarily for three reasons: the first is the added engagement that comes from putting the learning into a game context; second is the

interactive learning process employed; then the third is the way the two are put together in the whole package. GBL comes only when engagement and learning are both high so the core principle of GBL can promote learning at higher taxonomic levels is require and promote pedagogies such as problem solving and situated cognition integrated with instructional activities or content for the purpose to engaging students [3, 21]. In other word the success of GBL required and depends on how to design the game based learning, especially when move it into form learning, instructional design of GBL require considerable thinking. So teachers' role in GBL will differ from traditional classroom, teachers will play more as motivator for learning through engaged game; as debriefer for helping students reflect on what is being learned; as facilitator for guiding and facilitating learning by sound instructional design.

2.2 Relationship of Among the Educational Game, Motivation and Experience Learning

Instructional variables of games which can make games both educational and fun are variables of intrinsic motivation. Additionally, result of learning is also influenced by intrinsic motivation. Therefore, it's necessary to extract design variables which can support intrinsic motivation in instructional games, in order to bring theoretical change in developing instructional games. Games provide an engaging and immersive learning environment which is different from traditional learning. Many digital video games create a sense of sensory and physical immersion by using technologies resulting in one's feeling "inside" an environment. These environments are psychologically immersive in ways that the world-to-the-desktop interface is not [39].

In the environment game create which interactive fantasy, motivated, the player can play, practice actively. Game-based learning environment proved to increase participants' interest and motivate participants in exploring and engaging in the learning activities [42]. Digital game as a learning environment is a powerful pedagogy that allows for practice, operate, rehearse immersive in safe environment.

Squire [19] examines the history of games in educational research, and argues that the cognitive potential of games have been largely ignored by educators. Contemporary developments in gaming, particularly interactive stories, digital authoring tools, and collaborative worlds, suggest powerful new opportunities for educational media. These elements we argued will contribute to a good learning environment.

Games provide a rich learning environment in which students involved in and can operate by themselves with mentoring and apprenticeships in communities of practice. Begoña Gros [43] argued game with tremendous potential for reaching, motivating, and fully involving learners. Through the gaming, students can learn by doing and work with others through games, game can support children's learning inside and out of school. Learning by doing, this is great for Digital game-based learning, because "it turns out that doing is something that computer games are especially good at- they allow us to interact with them" [5, p.158].

Learn-by-doing is permeated into digital games, drill and practices, exploring, discovery, and problem solving are forms of doing required in games, in Game-based learning, students pursue a goal by practicing target skills and using relevant content knowledge to help them achieve their goal. The essential components of games: the goal, mission, storytelling scenario, operation, resources, feedback and ubiquitous coach are good at supporting learning by doing in video games.

Most often, the more fun a game is the less effective it is as a learning tool and vice versa. In fact, the quintessential combination of fun and learning seems almost impossible to achieve. This ideal scenario is an equal mixture of both learning and game content. It's not

easy to determine the intrinsic balance where both learning and gaming happen simultaneously. This has continued to be a hot issue in the development of educational games.

Games were consisting of variety elements which were graphics, complexity, interaction between players and system, narrative structure. There are encouraging signs that the concept of games for learning is gaining acceptance among educators. A majority of people believe that games are engaging, that they can be effective, and that they have a place in learning [21]. A 2006 survey by the United Kingdom's (UK) National Endowment for Science, Technology and the Arts Futurelab found that 60% of UK teachers would consider using games in the classroom for educational purposes and that almost one third have already used them in their classroom [44].

In the constructivist point of view on cognition, knowledge is generated from experience with tasks in authentic contexts rather than from isolated activities like memorizing facts and practicing skills separately [18]. Skills and knowledge are thus best acquired within a complex problem-rich context such as those presented by educational game, where a variety of problems can vary greatly in complexity and difficulty. As far as constructivists are concerned, using games for learning can play an important role in knowledge construction and composition and as an environment for problem solving skills.

Interest has been defined as the most basic and ubiquitous of universal motivating emotions for humans [45, 46]. Differential emotions theory describes how the emotion of interest motivates focused attention, receptivity to information, and learning across situations and throughout the life span [47].

According to Sansone and Smith [48], the proximal motivator for persistence and subsequent engagement, particularly for activities that take place over the long term, is the degree to which one experiences interest and enjoyment in a particular task. Individual interest has been described as the energizing force behind intrinsic motivation [49]. Although individual interest and intrinsic motivation are two separate constructs, they predict similar outcomes in that they both create and sustain a deepening involvement with content and affect over time.

Csikszentmihalyi [50] has described the autotelic or intrinsically motivated person as one who pays attention to things for their own sake without expecting an immediate return, is capable of sustained interest without recognition or with little support, and becomes caught up in the feedback loop between learning, interest, and enjoyment. The flow experience acts as a magnet for learning; an individual can enter the flow state by learning new skills, increasing challenges, or adding new cognitive layers to existing interests built on the foundation of past experience.

Dziabekco, et al [51] asserts that game-based learning provides to students with many ways for communication and acquiring information. Through the use of the game, the students gain easily new knowledge, since they have to search for it, understand it and use it in discussions with other students, who are member of others teams.

Based to these capabilities of virtual reality such as game, Winn [52] describes that the psychological processes that become active in immersive virtual reality are very similar to the psychological processes that operate when people construct knowledge through interaction with objects and events in the real world.

Such a convergence of learning processes with experiences permitted by technology is relatively rare and requires that we rigorously examine both the psychological and the technological sides of the equation. And also, to ensure the educational effectiveness of the learning environment, appropriate pedagogical methods should be considered, especially in the designing phase of the system [53].

Constructivism theory moves one step further than cognitivism considering that knowledge is constructed by learners themselves based on their personal experiences. Thus, learners acquire an active role within the learning process, since they not only absorb information, but also connect it with previously assimilated knowledge, constructing so their own interpretation [54].

Constructivists believe knowledge is actively constructed by the learners, depending on many contextual factors. Online learning enthusiasts often cite constructivism or social-constructivism as their preferred theoretical framework, especially in the virtual learning environment such as digital game.

Constructivists also advocate collaborative learning activities designed around peer-to-peer collaboration with the tutor being more of a facilitator. This can have the added value of improving the participants' soft-skills in team-building and communication. Time to reflect on experiences is also needed to allow meaningful knowledge to be processed and constructed into a perspective.

Consequently, learning with digital game can be characterized by that:

1. Improve learning performance: Some documented experiences note that there is a significant increase in user performance in understanding abstract problems when exploring 3D worlds with objects that represent the abstract entities [55];
2. Facilitate usability and enhance high interaction: for the navigation and manipulation of synthetic environments [56];
3. Revive unreachable learning experiences [57];
4. Stimulate high levels of involvement and give multiple perspective sensorial experiences [58];
5. Foster learner accessibility [59].

3. Research Methods

3.1 Research Question

This study aims to better understand the impact of activity level by learners on game-based learning, in particular when students actively engage in the learning process via educational game. The object is to find a meaningful difference in intrinsic motivation on activity level and sub-elements of intrinsic motivation between learners who use higher activity level and those who use low activity level on digital game-based learning.

3.2 Participants and Questionnaire

The target population for this study consisted of one hundred fifteen elementary school students in South Korea. They were from four classes taking "Mathematic class" at elementary school. There were 56-59 students in each class. Their ages ranged from 11 to 12 years old. One class was selected to perform Zoombini 2-Mountain Rescue, and the other class was selected to perform the game that Mathematic Classroom.

In this study, participants were divided into two groups. One group performed Zoombini 2-Mountain Rescue. Another group performed Mathematic Classroom. The off-line group followed the procedures of general digital storytelling suggested by the University of Houston. The activity for the Second

The educational games were selected through operational definitions and expert examination. Those had same subject matters but different levels of activity. Intrinsic Motivation Assessment Scale which was made by Harter's [60] assessment scale to have examined middle/high school students' intrinsic motivation, was used to check the learners' changes in their intrinsic motivation. That scale was reconstructed for questions suitable for educational games through expert examination, the reliability of the questions was satisfying as Cronbach's $\alpha = .84$.

3.3 Experimental Procedure

3.3.1 Procedure: The procedures were as follows: The learners were divided into two groups, considering the educational games' levels of activity and were treated with the experiment process in the same condition for six weeks. Students' grades of just before session are used as the result of a pre-test on intrinsic motivation. First, the teacher explained how to play the game. And the participants then played Zoombini 2-Mountain Rescue and Mathematic Classroom until they all reached the first level. This was done to ensure that players have the same gaming ability. They played the game, Zoombini 2-Mountain Rescue and Mathematic Classroom, about 80minutes a day (sum of classroom and homework), third a week, for six weeks. And then, the post-test for intrinsic motivation were administered.

3.3.2 Data Analysis: Quantitative data were collected and analyzed using SPSS 15.0 for Windows. The dependent variable is intrinsic motivation. The independent variable in this study is activity level in educational game.

3.3.3 The Game: In this study, two kinds of educational game according to the activity level by learners were used. One of this, higher activity level game is Zoombini 2-Mountain Rescue, the game is based around the "Zoombinis", a race of small blue creatures which are depicted with varying eyes, noses, hair, and feet. They are peaceful and successful, living on a small island called Zoombini Isle. Their lives are interrupted by a race called the Bloats, who offer to expand trade routes and improve the Zoombinis' quality of life; instead they take advantage of the situation and enslave the Zoombinis. The Zoombinis therefore decide to flee and search for a new home, and on their journey they encounter a variety of logic puzzles which the player must solve. The other game on low activity level is Mathematics Classroom game. Both games have in common is that elementary school's arithmetic operation is that dealing with the topic of learning

4. Results

The main purpose of this study was to examine the relationship between intrinsic motivation and activity level on educational game. In this study, one of the groups played the higher activity level's educational game, and the other group played the low activity level's educational game. Before and after the activity of educational experience via educational game, students' intrinsic motivation was measured using the tests mentioned above in the research methodology section. Two-independent sample *t*-tests and multivariate analysis were performed using the SPSS 15.0 statistics program.

The followings are results of the experiment. First, as shown Table1, according to the pre-test result, high activity level group and low activity level group could make sure that there is no significant between experimental group and control group as statistical by activity levels of educational game ($t=1.545$, $p>.05$). The result of the post-test of intrinsic motivation indicates

that there is a 0.38 points difference between learners who use games on the higher level of acting ($M=3.68$, $SD=.385$, $t=5.649$, $p<.001$) and learners on the lower level of activity ($M=3.11$, $SD=.649$, $t=5.649$, $p<.001$).

Therefore, there was a meaningful difference in intrinsic motivation between learners who use games on the higher level of activity and learners on the lower level of activity in game-based learning. To identify the experimental treatments effect, we calculated the effect size. As the result, effect size was *Cohen's d* = 1.07. It means that was effective rather high activity level games than low activity level games.

Table 1. Intrinsic Motivation by Activity Levels

Test	activity Level	N	M	SD	t	Sig.
Pre	Low	59	2.85	.78	1.545	0.125
	High	56	3.04	.56		
Post	Low	59	3.11	.65	5.649	0.000
	High	56	3.68	.38		

*** Correlation is significant at the 0.001 level.

As indicated in the table above, the difference in the mean change score of intrinsic between the two groups was significant, $t=5.649$, $p<.001$. The mean change score of intrinsic motivation in higher activity level group ($M=3.68$, $SD=.38$) was significantly higher than that of the low activity level group ($M=3.11$, $SD=.65$). The alpha level was .001. The mean change score has been improved .57 point. Namely, the activity of intrinsic for high of activity level was effective in improving students' intrinsic motivation.

The intrinsic motivation scales assess five dimensions of motivation. The scale consists of 5 sub-categories containing a total of 30 items. We used multivariate analysis to verify the variations in intrinsic motivation level among sub-category variables. Results of the post-intrinsic motivation multivariate analysis of the relationship between the groups are displayed in Table 2. According to the result, there was significant difference between virtual reality learning group looks like high activity level in Zoombini 2-Mountain Rescue and low activity level with Mathematics Classroom for intrinsic motivation ($\lambda=.730$, $p=.001$).

In other words, the group that performed the learning experience activity in game of higher activity level experienced a higher level of intrinsic motivation than the group that did the digital game activity with low activity level.

Table 2. Results of Multivariate Analysis for Intrinsic Motivation (Wilks' $\lambda=.730^{*}$, $p<.001$)**

Variance Sources		M	SD	F	p	η^2
Challenge	Low(n=59)	3.11	.65	31.913***	.000	.220
	High(n=56)	3.69	.39			
Curiosity	Low(n=59)	3.15	1.33	.034	.854	.000

	High(n=56)	3.11	.70			
Mastery	Low(n=59)	3.30	.74	.796	.374	.007
	High(n=56)	3.42	.80			
Independent	Low(n=59)	3.09	.82	10.745***	.001	.087
	High(n=56)	3.53	.61			
Criteria	Low(n=59)	3.68	.91	.354	.553	.003
	High(n=56)	3.80	1.42			

*** Correlation is significant at the 0.001 level.

From the results of the Multivariate Analysis of Variance (MANOVA), among the five categories of intrinsic motivation (Challenge, Curiosity, Mastery, Independent, Criteria), a significant difference existed among activity level groups (Wilks' $\lambda = .730$, $p < 0.001$). Wilks' λ represents the part of within-group variation against total variation, where a Wilks' λ close to 0 means that differences between groups are major.

According to η^2 , which represents the explanatory power of the independent variable, 8.7% of total change score can be explained as the contribution of Independent, 0.7% as the contribution of Mastery, 0.3% as the contribution of Criteria, 0% as the contribution of Curiosity, 7% as the contribution of total concentration, 23% as the contribution of sense of control. The main factors contributing to intrinsic motivation in educational game are Challenge, Independent.

It is considered that the result can be enough information for learners, parents of students and teachers who try to use and develop educational games. For example, it can be an idea to construct menus considering characteristics of learners in various steps of designing and developing educational games. And it can help to improve learners' intrinsic motivation especially if games are developed, distinguishing games for extrovert learners from those for introvert learners. The main result of the research is that it is possible to stimulate learners' motivation enough by only games.

5. Conclusion

Video games and computer games have become an important part of young people's lives particularly in advanced countries. Young people are often called the Net Generation, the Gamer Generation, and the Digital Natives because they have embraced and learned to speak the digital language of computers, video games, and the Internet. Digital technologies are changing the new generations' values, learning skills, and educational achievements. Therefore, increasing in computer games as the next generation's educational method and the research body on learning based on games is growing more than ever before.

Today's students have sophisticated technology skills, and technology offers students all kinds of new and highly effective tools which they can use to learn on their own, and digital games could be a case. But students' information literacy, especially with respect to judging the quality of information is unacceptably weak [61]. In addition, critics and hinders in using digital games in classrooms such as excessive use or addiction and time and energy consuming are also listed [2, 4, 5].

A digital game learning environment should support a natural way of interaction, which mimics as close as possible the real world, contributing so to the easy and fast familiarization and adaptation of users to the digital game learning environment. And also, the interactive points should be clear and supported by suitable signs inciting users to interact with good learning environment.

The proliferation of digital technologies has accentuated the need for creative thinking in all aspects of our lives, and has also provided tools that can help us improve and reinvent ourselves. Throughout the world, computing and communications technologies are sparking a new entrepreneurial spirit, the creation of innovative products and services, and increased productivity. The importance of a well-educated, creative citizenry is greater than ever before [4].

The result of this research, there are meaningful difference in intrinsic motivation between learners who use games on the higher level of activity and learners on the lower level of activity in game-based learning. And also, the intrinsic motivation of extrovert learners' improved more than that of introvert learners' in game-based learning. It is expected that the results of this study would suggest how to utilize educational games in teaching and learning. It is considered that the result can be enough information for learners, parents of students and teachers who try to use and develop educational games.

For example, it can be an idea to construct menus considering characteristics of learners in various steps of designing and developing educational games. And it can help to improve learners' intrinsic motivation especially if games are developed, distinguishing games for extrovert learners from those for introvert learners.

Most educators have been worried that game play has a negative effect on academic achievements while students spend a great deal of time playing entertainment factors. However, even fantasy can be helpful to the academic achievements indirectly by stimuli person's characteristics. This may justify educators' participation in designing, developing, and utilizing educational games not just for fun, but with fun.

In education, computer games must be examined for two important reasons. Firstly, it is essential that teachers understand the media environment their students experience and participate in, so that they may instruct them in being informed and critical members of it.

Secondly, teachers can and should use its language, which their students understand best, in order to further learning. This paper will seek to examine the inherent ideology of computers and computer games (especially commercial games), in order to clarify the meaning and importance of these media, including issues of gender and violence. How and why children today play computer games will also be examined. The generational changes that have occurred since the emergence of the computer and the computer game, changing the patterns of play (and of thinking) of today's students are of great importance for teachers who wish to better understand their students' experiences with computers, and computer games in particular.

In the future in classroom lesson, digital game-based learning can be applied as additional option to classroom lecturing for teacher and students. Intention of digital game-based learning is to address new and ICT based didactical approaches to learning and at the same time to provide learners the possibility to acquire skills and competencies later required in the business world. By means of educational games learners should be able to apply factual knowledge [62, 63].

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